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Future BSM studies using UPCs with ALICE at the LHC

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The search for physics beyond the Standard Model (BSM) is one of the main goals of the LHC. Compared to standard proton-proton collision studies, heavy-ion collisions provide unique and complementary means to search for new phenomena. In particular, ultra-peripheral collisions (UPCs) of heavy ions offer a natural environment for the studies of photon-mediated processes, such as light-by-light scattering, axion-like particle searches and τ $g-2$ measurements.

A precise experimental determination of the tauon anomalous electromagnetic moment a_τ is of great interest, since it increases the sensitivity to BSM physics by a factor of $m_\tau/m_\mu \sim 280$ compared to measurements with muons. However, while the anomalous electromagnetic moments of the electron and muon were measured with high precision, results on tauons are still rather poor. The current best limits are 15 years old and were obtained by the DELPHI collaboration by a measurement of the $e^+e^- \to e^+e^-\tau\tau$ cross section. Here we will discuss a method for measuring a_τ in heavy-ion UPCs and provide prospects for such a measurement with ALICE in the LHC Run 3.

In addition we will provide an outlook on measurements with ALICE 3, the proposed next-generation LHC experiment for LHC Run˜5 and beyond. At that time, the upgraded LHC accelerator will deliver beams of high luminosity, which together with a novel detector design will enable detailed studies of light-by-light scattering and to search for axion-like particles in a poorly explored range of diphoton invariant masses from 50 MeV/c^2 to 5 GeV/c^2.

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